6.3 Energy and Momentum in Space

SECTION EXPECTATIONS

- Apply quantitatively the law of conservation of linear momentum.
- Analyze the factors affecting the motion of isolated celestial objects.

KEY TERMS

- combustion chamber
- exhaust velocity
- thrust
- reaction mass
- gravitational assist or gravitational slingshot

Collisions in space are among the more interesting celestial events. The collision of comet Shoemaker-Levy 9 in July of 1994 created great excitement for both astronomers and the general public. Other collisions in the past have greatly affected Earth. The demise of the dinosaurs, along with about 70% of all other species, is attributed to a collision between Earth and an asteroid some 65 million years ago. Remains of such a collision can be seen on the sea floor of the Gulf of Mexico near the coast of the Yucatan Peninsula.

More recently, on June 30, 1908, an object with a mass of about one hundred thousand tonnes slammed into Earth's atmosphere above Siberia, not far from the Tunguska River. The explosion, which occurred about eight kilometres above the ground, flattened one hundred thousand square kilometres of forest, killing all of the wildlife in the area. Since the region is remote, no humans are thought to have perished.

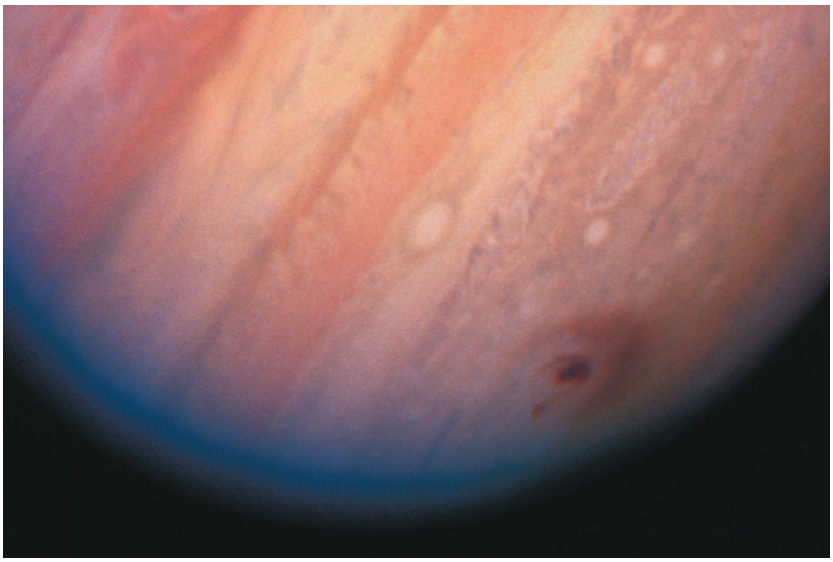

Figure 6.5 The dark blemishes on the face of Jupiter after the collision with the comet Shoemaker-Levy 9 mark the impact locations of fragments of the comet.

Not all celestial collisions are devastating. Present theories about the formation of our solar system suggest that planets were formed as a result of collisions of smaller rocky objects. If the collisions were energetic enough, they would have generated enough thermal energy to fuse the rocks together into a larger mass.